

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
28 August 2003 (28.08.2003)

PCT

(10) International Publication Number  
**WO 03/070510 A1**

(51) International Patent Classification<sup>7</sup>:

**B60N 2/28**

(21) International Application Number:

PCT/CA03/00226

(22) International Filing Date: 19 February 2003 (19.02.2003)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2,372,829 19 February 2002 (19.02.2002) CA

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(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

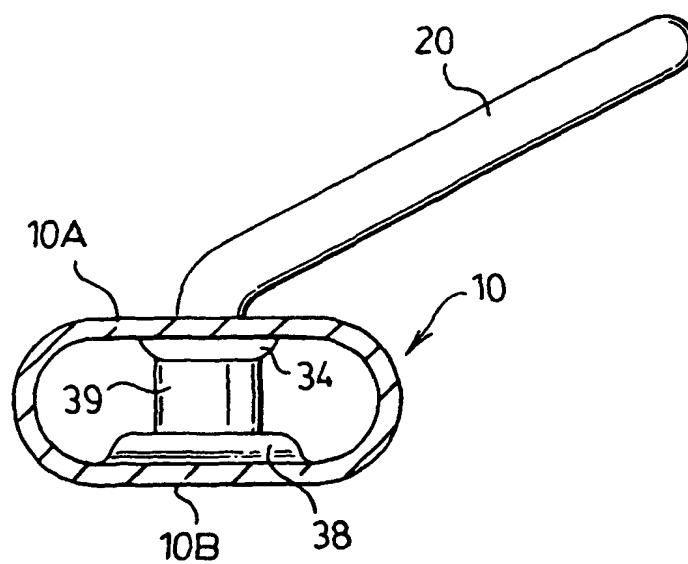
- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: WELDLESS CHILD SAFETY RESTRAINT SYSTEM FOR AN AUTOMOBILE AND ITS MANUFACTURING METHODS



**WO 03/070510 A1**



(57) Abstract: An automobile child safety restraint system, comprising an anchoring bar (10) at least one wire anchoring loop (20) affixed to the tubular anchoring bar (10) without welding, and a method of manufacturing same.

**WELDLESS CHILD SAFETY RESTRAINT SYSTEM FOR AN AUTOMOBILE  
AND ITS MANUFACTURING METHOD**

**FIELD OF THE INVENTION**

5        This invention relates to safety systems. In particular, this invention relates to a child seat safety restraint system for an automobile and a method of manufacturing the child safety restraint system.

**BACKGROUND OF THE INVENTION**

10      The National Highway Traffic Safety Administration, Department of Transportation maintains rigid safety standards for motor vehicles. Title 49, Chapter V, Section 571.213, which is incorporated herein by reference, specifies requirements for child restraint systems used in motor vehicles.

15      In a typical child restraint system for an automobile, a specially built child safety seat is tethered to an anchoring structure built into the vehicle. Many existing automobile child restraint systems are deficient, and the anchoring structure can fail to adequately secure child seat in an accident. In a conventional child restraint system a loop of wire is welded to an anchoring bar which is in turn bolted to the vehicle chassis.

20      Welding can result in inconsistent joints and deteriorated surfaces surrounding the weld, which can weaken the anchoring structure. Welding is a slow, labour-intensive, and dirty process which creates quality control concerns, even when welding is effected by a skilled welder. The effectiveness of a weld is typically assessed visually, and problems such as burn-through, metal fatigue in the material surrounding the weld, incomplete adhesion due to contaminants on the tubular components and so on, are not always avoidable. In automobile applications, these types of problems can cause serious safety concerns.

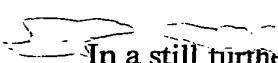
**SUMMARY OF THE INVENTION**

The present invention provides a weldless child restraint system wherein at least one wire anchoring loop is securely affixed to an anchoring bar without welding.

The invention thus provides a consistently strong and easy to assemble child restraint system which meets and exceeds relevant current requirements.

In a first embodiment of the invention the wire anchoring loop has free ends extending through the bar, which are swaged and then nuts or other suitable engaging means are affixed to the free ends. Preferably the nuts seat in recesses formed in the bottom surface of the anchoring bar so that no portion of the wire anchoring loop projects beyond the bottom surface. The tip of each free end may be punched or flattened to lock the nuts securely in place. The wire anchoring loop 20 is bent forwardly so as to protrude from between the automobile seat bottom and seat back, to be exposed for use.

In a further embodiment of the invention the free ends of the wire anchoring loop extend through a cord of the curved front edge of the anchoring bar at an angle relative to its top surface. The anchoring loop is thus positioned to protrude from between the automobile seat bottom and seat back, to be exposed for use. The tip of each free end is punched, flattened or otherwise deformed to form a head, which is preferably seated in an ovate recess formed in the bottom surface of the anchoring bar so that no part of the wire anchoring loop projects below the anchoring bar.

 In a still further embodiment the free ends of the wire anchoring loop extend along a cord through the curved front edge of the anchoring bar, but each free end is initially positioned to project beyond the bottom surface of the anchoring bar and then struck to simultaneously form a recess in the bottom surface and a curve in the free end of the wire anchoring loop. This embodiment does not require swages.

In a still further embodiment of the invention the anchoring bar is roll formed and wire anchoring loops are secured to the top surface of the anchoring bar before the anchoring bar is rolled into tubular form. The wire anchoring loop is swaged to restrain the loop against slipping down into the anchoring bar, and is secured beneath the top surface. The wire anchoring loop is preset to the protrusion angle which will optimise exposure through the automobile seats for use.

In a still further embodiment of the invention the anchoring bar is formed from mating extrusions. The free ends of the wire anchoring loop are disposed through openings in the top extrusion and the tips of the free ends each secured with a head formed by a nut, deformation or other suitable enlargement. The bottom 5 extrusion is secured to the top extrusion by a tongue in channel arrangement. The head is contained within a recess in the floor of channel, so that when the extrusions are joined the heads are supported by the tongue, which both stabilizes the wire anchoring loop and prevents it from slipping into the anchoring bar.

In a still further embodiment of the invention a pair of round holes 10 approximating the diameter of the wire anchoring loop are punched through the wall of the anchoring bar opposite a pair of oblong holes having a length approximately twice the diameter of the wire anchoring loop. The anchoring loop is bent into a "U" shape and inserted through the holes so that the legs project well beyond the anchoring bar. The legs are bent to produce a double diameter corresponding to the 15 lengths of the oblong holes, the anchoring loop is pulled back through the anchoring bar until the free ends contact the inner wall of the anchoring bar, and the oblong holes are crimped to rigidly retain the anchoring loop within the anchoring bar.

The present invention thus provides a method of manufacturing an anchoring bar for a safety restraining system in an automobile, comprising the steps 20 of: a. disposing at least one wire anchoring loop through holes in the anchoring bar; and b. securing the wire anchoring loop against movement or detachment from the anchoring bar without welding.

In further aspects of the method: the wire is secured by swaging free ends 25 of the anchoring loop, disposing the free ends through holes in the anchoring bar until the swages contact the anchoring bar, and applying an enlargement to the exposed free ends of the anchoring loop to bear against the anchoring bar; the enlargement is applied by striking the free ends of the anchoring bar; the enlargement is applied by threading a nut to the free end; bushings are inserted between opposed holes in the anchoring bar, wherein the anchoring loop is inserted through the bushings; the 30 anchoring loop is applied to a sheet, the enlargement is applied to the exposed free

ends, and the sheet is rolled into a tubular form, whereby the enlargement bears against an interior wall of the anchoring bar; or the anchoring loop is inserted through an extrusion, the enlargement is applied to the exposed free ends, and the extrusion is affixed to the anchoring bar.

5           The present invention further provides an anchoring bar for an automobile safety restraint system, comprising an elongated tubular bar member having openings disposed therein, and at least one wire anchoring loop having free ends disposed through the openings in the tubular anchoring bar and affixed to the tubular anchoring bar without welding.

10          In further aspects of the anchoring bar of the invention: free ends of the anchoring loop are swaged and disposed through holes in the anchoring bar until the swages contact the anchoring bar, and comprising an enlargement applied to the exposed free ends of the anchoring loop to bear against the anchoring bar; the enlargement is applied by striking the free ends of the anchoring bar; the enlargement  
15         is applied by threading a nut to the free end; the anchoring bar further comprises bushings disposed between opposed holes in the anchoring bar, wherein the anchoring loop passes through the bushings; the anchoring loop is affixed to a sheet and the sheet is rolled into a tubular form, whereby the enlargement bears against an interior wall of the anchoring bar; or the anchoring loop is affixed to an extrusion, and the  
20         extrusion is affixed to the anchoring bar.

             The invention further provides a method of affixing a wire anchoring loop to an anchoring bar for an automobile safety restraint system, comprising the steps of:  
a. forming through a wall of the anchoring bar, a first pair of holes approximating a diameter of the anchoring loop; b. forming through a wall of the anchoring bar,  
25         substantially diametrically opposite the first pair of holes, a pair of oblong holes having a length approximately twice the diameter of the anchoring loop 20; c. bending the anchoring loop into a "U" shape to produce legs having a length at least three times the outside diameter of the anchoring bar; d. inserting the legs of the anchoring loop through the first pair of holes and then through the oblong holes, so that the legs  
30         project beyond the anchoring bar by a length equal to at least twice an inside diameter

- of the anchoring bar; e. bending the legs in a direction of the length of the oblong holes, to produce return portions having a length approximating the inside diameter of the anchoring bar creating, with upper portions of the legs, a double diameter having an overall width substantially corresponding to the length of the oblong holes; f. 5 pulling the anchoring loop back through the anchoring bar until the return portions contact the inner wall of the anchoring bar; and g. crimping the oblong holes to rigidly retain the anchoring loop within the anchoring bar. In a further aspect of the method the length of the oblong holes is substantially aligned with the length of the anchoring bar.

10 **BRIEF DESCRIPTION OF THE DRAWINGS**

In drawings which illustrate by way of example only a preferred embodiment of the invention,

Figure 1 is a perspective view of an anchoring bar having a weldless child restraint system according to the invention.

15 Figure 2A is a top perspective view of a section of anchoring bar embodying a first embodiment of the invention.

Figure 2B is a bottom perspective view of the embodiment of Figure A.

Figure 2C is a cross-sectional elevation of the embodiment of Figure 2A.

20 Figure 3A is a top perspective view of a section of anchoring bar embodying a further embodiment of the invention.

Figure 3B is a bottom perspective view of the embodiment of Figure 3A.

Figure 3C is a cross-sectional elevation of the embodiment of Figure 3A.

Figure 4A is a top perspective view of a section of anchoring bar embodying a further embodiment of the invention.

25 Figure 4B is a bottom perspective view of the embodiment of Figure 4A.

Figure 4C is a cross-sectional elevation of the embodiment of Figure 4A.

Figure 5A is a top perspective view of a section of anchoring bar embodying a further embodiment of the invention.

Figure 5B is a bottom perspective view of the embodiment of Figure 5A.

Figure 5C is a cross-sectional elevation of the embodiment of Figure 5A.

5           Figure 6A is a top perspective view of a section of anchoring bar embodying a further embodiment of the invention.

Figure 6B is a cross-sectional elevation of the embodiment of Figure 6A.

Figure 7A is a partially cutaway elevation of a further embodiment of the invention.

10          Figures 7B to 7F are schematic views showing stages in the manufacture of the embodiment of Figure 7A.

#### DETAILED DESCRIPTION OF THE INVENTION

The invention, illustrated in Figure 1, is a child safety restraint system for an automobile. An anchoring structure comprises an elongated, preferably tubular member or bar 10 affixed (bolted or by any other suitable means) to brackets 12, which in turn provide holes for bolting the anchoring bar 10 to the floor or chassis of an automobile. The anchoring bar 10 supports seat mounting brackets 14 to which the automobile seats (not shown) are mounted. The anchoring bar 10 as described thus far is conventional and will be well known to those in the automobile industry.

20          According to the preferred embodiment of the invention, wire anchoring loops 20 are affixed to the anchoring bar 10 without welding. In a first embodiment of the invention, illustrated in Figures 2A to 2C, the wire anchoring loop 20 has free ends 30 extending through the bar 10. The free ends 30 are swaged as at 32, the swages being preferably seated in recesses 34 formed in the top surface 10A of the anchoring bar 10. Nuts 36 are affixed to the free ends 30, for example nuts 36 may be threaded and the free ends 30 of wire loop 20 provided with a compatible thread, or other suitable engaging means may be employed to affix nuts 36 to the free ends 30. Preferably the nuts 36 seat in recesses 38 formed in the bottom surface 10B of the

anchoring bar 10 so that no portion of the wire anchoring loop 20 projects beyond the bottom surface 10B, as can be seen in Figure 2C. Preferably the tip of each free end 30 is then punched or flattened, to lock the nuts 36 securely in place. The anchoring bar 10 is thus locked between the swages 32 and the nuts 36. In this embodiment the 5 free ends 30 extend through the anchoring bar 10 substantially centrally along the top and bottom surfaces 10A, 10B, respectively, so that the free ends 30 are oriented generally vertically; the wire anchoring loop 20 is bent forwardly so as to protrude from between the automobile seat bottom and seat back, to be exposed for use. If desired a bushing, sleeve or other support 39 may be disposed over each free end 30 to 10 provide support between the top and bottom surfaces 10A, 10B of the anchoring bar 10, as shown in Figure 2C.

In a further embodiment of the invention, illustrated in Figures 3A to 3C, the free ends 40 of wire anchoring loop 20 extend through a cord of the curved front edge 10C of the anchoring bar 10, at an angle relative to the top surface 10A of the 15 anchoring bar 10. The anchoring loop 20 is thus positioned to protrude from between the automobile seat bottom and seat back, to be exposed for use. The free ends 40 are swaged as at 42, and the swage is preferably seated in recesses 44 formed in the curved front edge 10C. The tip 46 of each free end 40 is punched, flattened or otherwise deformed to form a head 46, thereby locking the anchoring bar 10 between 20 the heads 46 and the swages 42. Preferably the heads 46 are seated in ovate recesses 48 formed in the bottom surface 10B of the anchoring bar 10, so that no part of the wire anchoring loop projects below the bottom surface 10B of the anchoring bar 10.

In a still further embodiment of the invention, illustrated in Figures 4A to 4C, the free ends 50 of wire anchoring loop 20 extend along a cord through the curved 25 front edge 10C of the anchoring bar, as in the previous embodiment. In this embodiment, the free ends 50 are initially positioned to project beyond the bottom surface 10B of the anchoring bar 10, and the free ends 50 are then struck, preferably by a ball or other similar striking tool, to simultaneously form a recess 58 in the bottom surface 10B of the anchoring bar 10 and a curve 56 in the free end 50 of the 30 wire anchoring loop 20. This embodiment does not require swages in the wire anchoring loop 20, since the curved portions 56 of the free ends 50 are sunk into the

recesses 58 formed in the bottom surface 10B and thereby set in the wall of the anchoring bar 10, as shown in Figure 4C, so the wire anchoring loop cannot slip downwardly into the anchoring bar 10.

In a still further embodiment of the invention, illustrated in Figures 5A to 5C, the anchoring bar 60 is roll formed. In this embodiment wire anchoring loops 20 are secured only to the top surface 60A of the anchoring bar 60, and are secured before the anchoring bar 60 is rolled into tubular form. The wire anchoring loop 20 is swaged as at 62, to restrain the loop 20 against slipping down into the anchoring bar 10, and is secured beneath the top surface 60A as by nuts 64, as shown in Figure 5C, or in any other suitable fashion. In this embodiment the wire anchoring loop 20 is affixed to the portion of the metal flat which will become the front edge 60C, preset to the protrusion angle which will optimise exposure through the automobile seats for use. The flat is then rolled to form the anchoring bar 60, preferably with the seam 61 located centrally along the bottom surface 60B, as shown in Figure 5B. The front edge 60C may have a flattened portion, as best seen in Figure 5C, so that the swages 62 and nuts 64 conform to the abutting surfaces of front edge 60C, to better stabilize the wire anchoring loop 20.

In a still further embodiment of the invention, illustrated in Figures 6A to 6B, the anchoring bar 70 is formed from mating extrusions 72, 74, which may for example be formed from aluminium. Free ends 82 of wire anchoring loop 20 are disposed through openings 76 in top extrusion 74 and the tips of free ends 82 are each secured with a head 86, formed by a nut, deformation or other suitable enlargement affixed to or formed in the tips of free ends 82. The bottom extrusion 72 is secured to the top extrusion 74 by mating tongue 73 with channel 78. The head 86 is contained within a recess 78A in the floor of channel 78, so that when the extrusions 72, 74 are joined, the heads 86 on free ends 82 are supported by the tongue 73, which thus both stabilizes the wire anchoring loop 20 and prevents it from slipping into the anchoring bar 70.

Figure 7A illustrates a further embodiment of the invention, manufactured according to the stages illustrated in Figures 7B to 7F. In this embodiment an

anchoring bar 10 has an inside diameter greater than the diameter of the wire anchoring loop 20. As shown in Figure 7B, a pair of round holes 90 approximating the diameter of the wire anchoring loop 20 are punched or otherwise formed through the wall of the anchoring bar 10. A pair of oblong holes 92 having a length approximately 5 twice the diameter of the wire anchoring loop 20, preferably but not necessarily aligned with the length of the anchoring bar 10, are punched or otherwise formed through the wall of the anchoring bar 10 substantially diametrically opposite to the holes 90.

The wire anchoring loop 20 is bent into a "U" shape as illustrated in Figure 10 7C, with the legs 22 having a length at least three times the outside diameter of the anchoring bar 10. The legs 22 of the anchoring loop 20 are inserted first through the holes 90 and then through the holes 92, as illustrated in end elevation in Figure 7D, so that the legs project well beyond the anchoring bar 10, by a length equal to at least 15 twice the inside diameter of the anchoring bar 10. The legs 22 are bent in the direction of the length of the oblong holes 92, to produce return portions 24 the length of which approximates the inside diameter of the anchoring bar 10, as shown in Figure 7E. The return portions are bent substantially fully against the upper leg portions 26 to produce a double diameter having an overall width substantially corresponding to the lengths of the oblong holes 92, as shown in Figure 7F. The anchoring loop 20 is pulled back 20 through the anchoring bar 10 until the free ends 30 contact the inner wall of the anchoring bar 10, adjacent to the holes 90, and the holes 92 are crimped to rigidly retain the anchoring loop 20 within the anchoring bar 10.

Various embodiments of the present invention having been thus described in detail by way of example, it will be apparent to those skilled in the art that 25 variations and modifications may be made without departing from the invention. The invention includes all such variations and modifications as fall within the scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method of manufacturing an anchoring bar for a safety restraining system in an automobile, comprising the steps of:
  - a. disposing at least one wire anchoring loop through holes in the anchoring bar; and
  - b. securing the wire anchoring loop against movement or detachment from the anchoring bar without welding.
2. The method of claim 1 in which the wire is secured by swaging free ends of the anchoring loop, disposing the free ends through holes in the anchoring bar until the swages contact the anchoring bar, and applying an enlargement to the exposed free ends of the anchoring loop to bear against the anchoring bar.
3. The method of claim 2 in which the enlargement is applied by striking the free ends of the anchoring bar.
4. The method of claim 2 in which the enlargement is applied by threading a nut to the free end.
5. The method of claim 1 comprising the step of inserting bushings between opposed holes in the anchoring bar, wherein the anchoring loop is inserted through the bushings.
6. The method of claim 2 in which the anchoring loop is applied to a sheet, the enlargement is applied to the exposed free ends, and the sheet is rolled into a tubular form, whereby the enlargement bears against an interior wall of the anchoring bar.
7. The method of claim 2 in which the anchoring loop is inserted through an extrusion, the enlargement is applied to the exposed free ends, and the extrusion is affixed to the anchoring bar.
8. An anchoring bar for an automobile safety restraint system, comprising an elongated tubular bar member having openings disposed therein, and at least one wire

anchoring loop having free ends disposed through the openings in the tubular anchoring bar and affixed to the tubular anchoring bar without welding.

9. The anchoring bar of claim 8 in which free ends of the anchoring loop are swaged and disposed through holes in the anchoring bar until the swages contact the anchoring bar, and comprising an enlargement applied to the exposed free ends of the anchoring loop to bear against the anchoring bar.

10 The anchoring bar of claim 9 in which the enlargement is applied by striking the free ends of the anchoring bar.

11. The anchoring bar of claim 9 in which the enlargement is applied by threading a nut to the free end.

12. The anchoring bar of claim 8 comprising bushings disposed between opposed holes in the anchoring bar, wherein the anchoring loop passes through the bushings.

13. The anchoring bar of claim 9 in which the anchoring loop is affixed to a sheet and the sheet is rolled into a tubular form, whereby the enlargement bears against an interior wall of the anchoring bar.

14. The anchoring bar of claim 9 in which the anchoring loop is affixed to an extrusion, and the extrusion is affixed to the anchoring bar.

15. A method of affixing a wire anchoring loop to an anchoring bar for an automobile safety restraint system, comprising the steps of:

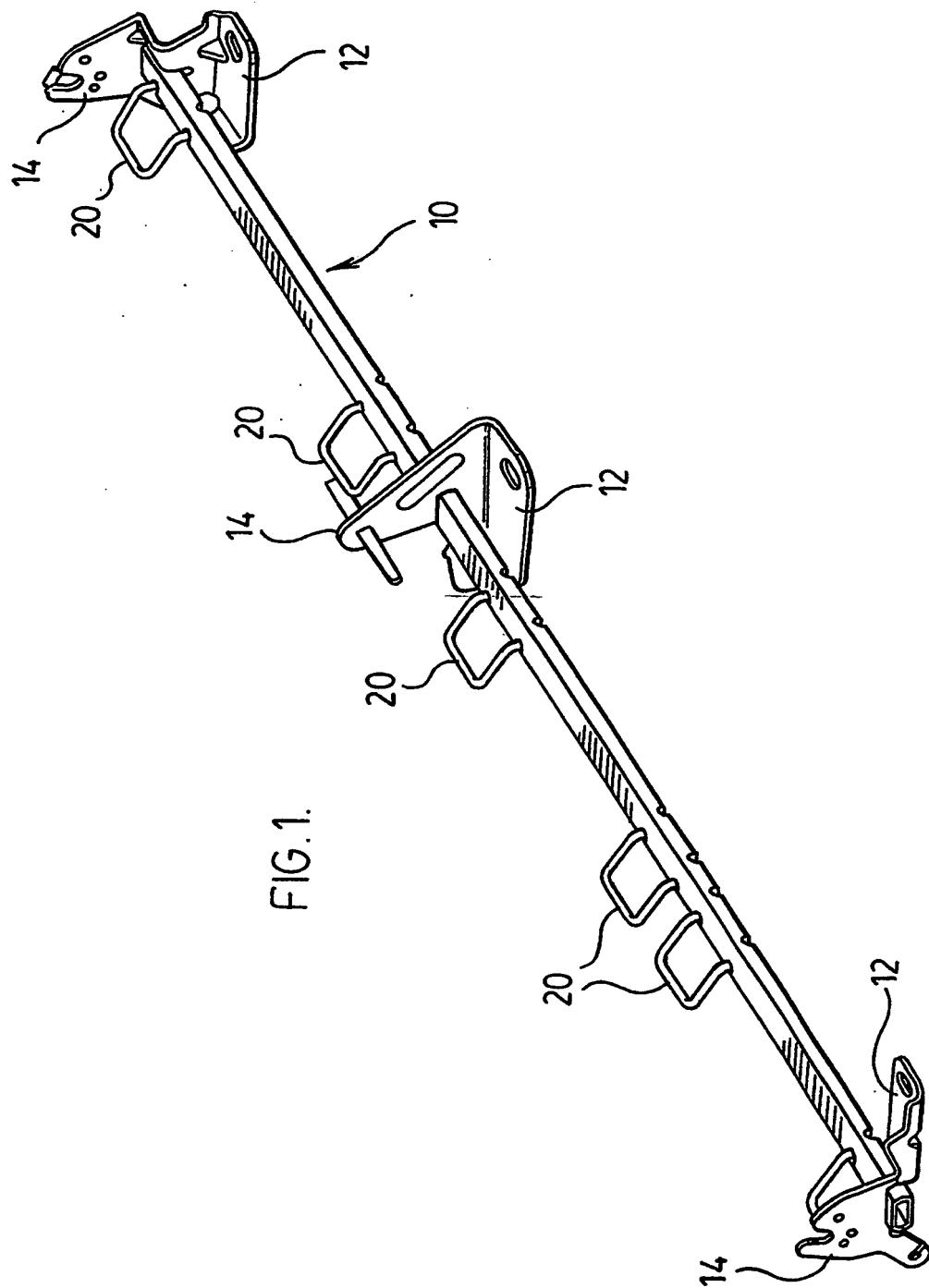
a. forming through a wall of the anchoring bar, a first pair of holes approximating a diameter of the anchoring loop;

b. forming through a wall of the anchoring bar, substantially diametrically opposite the first pair of holes, a pair of oblong holes having a length approximately twice the diameter of the anchoring loop 20;

c. bending the anchoring loop into a "U" shape to produce legs having a length at least three times the outside diameter of the anchoring bar;

- d. inserting the legs of the anchoring loop through the first pair of holes and then through the oblong holes, so that the legs project beyond the anchoring bar by a length equal to at least twice an inside diameter of the anchoring bar;
  - e. bending the legs in a direction of the length of the oblong holes, to produce return portions having a length approximating the inside diameter of the anchoring bar creating, with upper portions of the legs, a double diameter having an overall width substantially corresponding to the length of the oblong holes;
  - f. pulling the anchoring loop back through the anchoring bar until the return portions contact the inner wall of the anchoring bar; and
  - g. crimping the oblong holes to rigidly retain the anchoring loop within the anchoring bar.
16. The method of claim 15 in which the length of the oblong holes is substantially aligned with the length of the anchoring bar.

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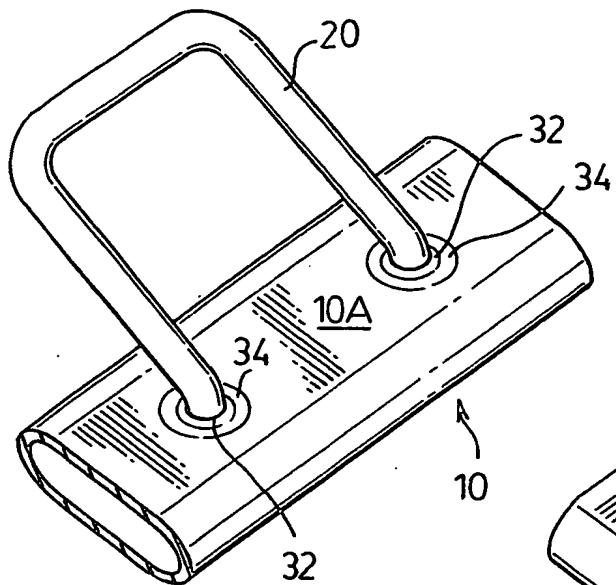


FIG. 2A.

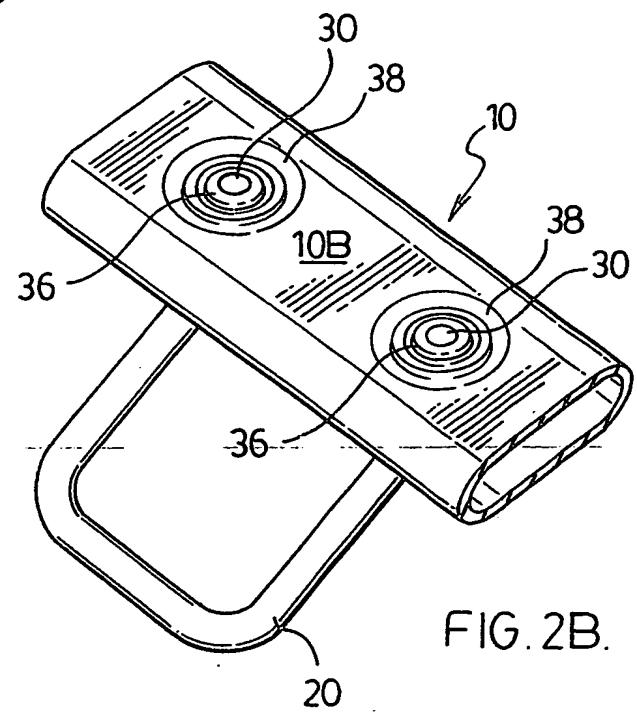


FIG. 2B.

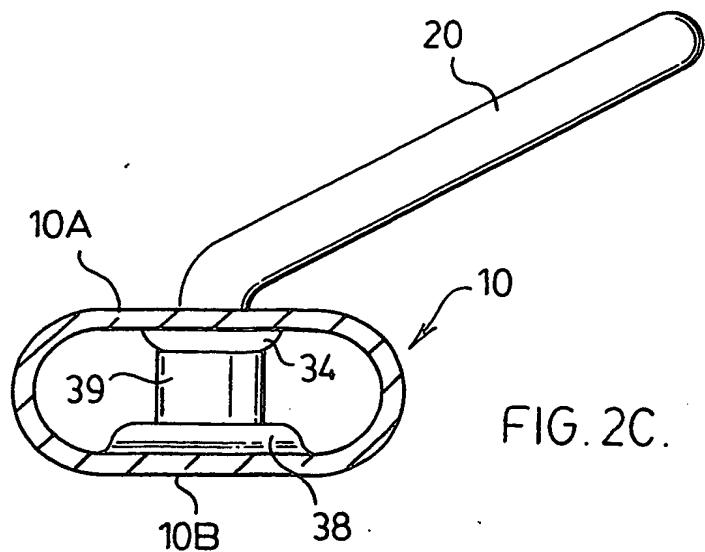


FIG. 2C.

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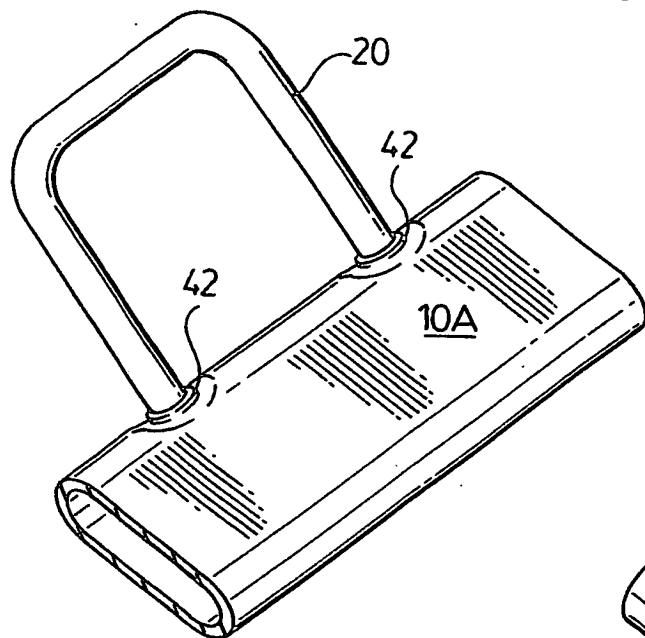


FIG. 3A.

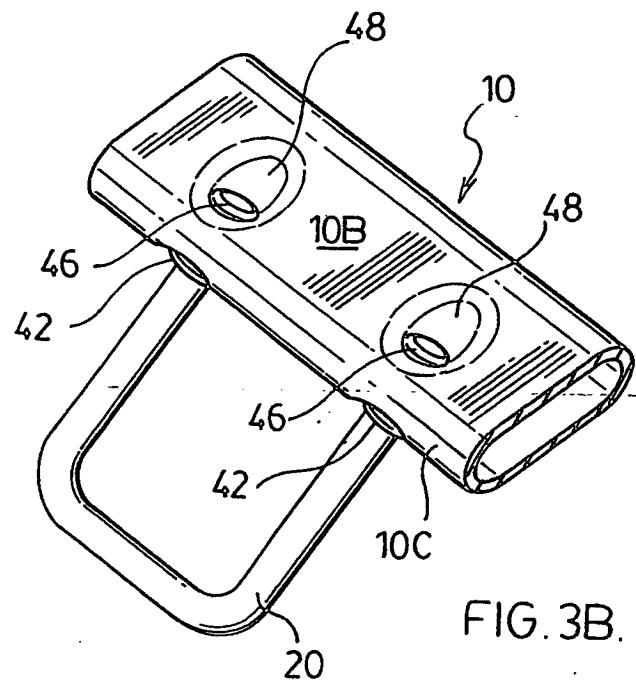


FIG. 3B.

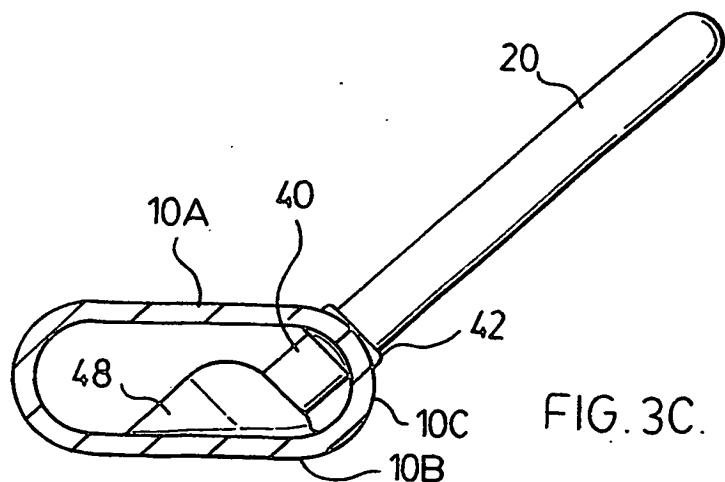


FIG. 3C.

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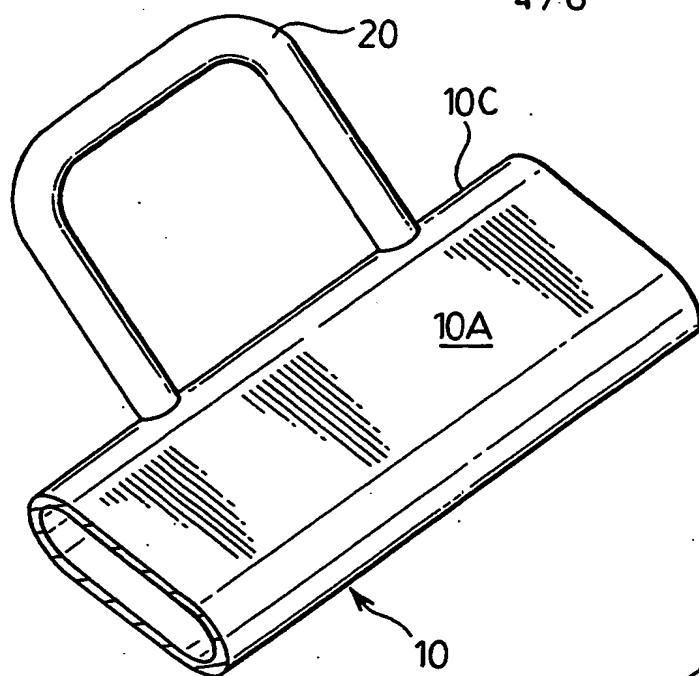


FIG. 4A.

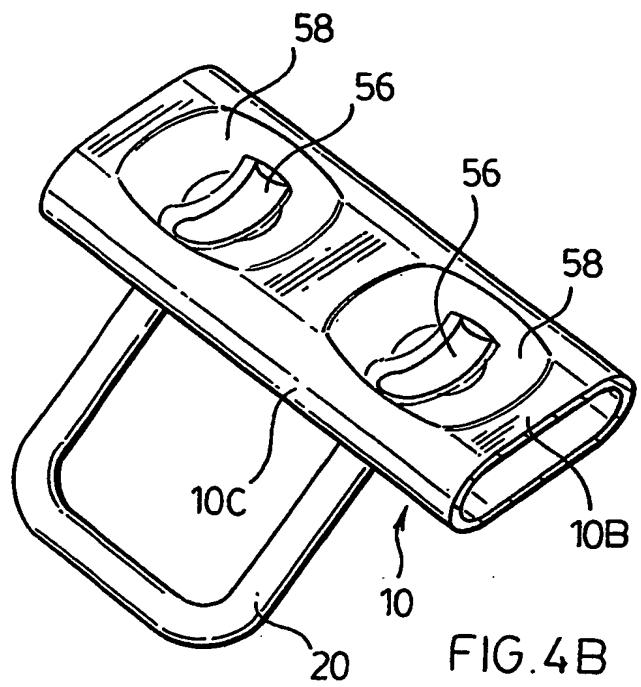


FIG. 4B

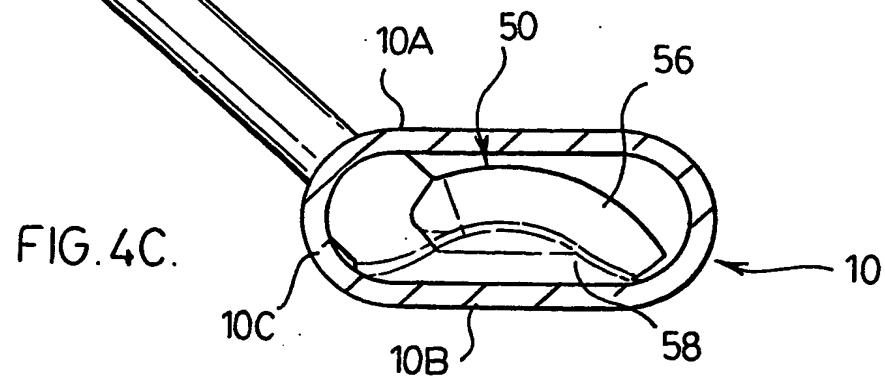
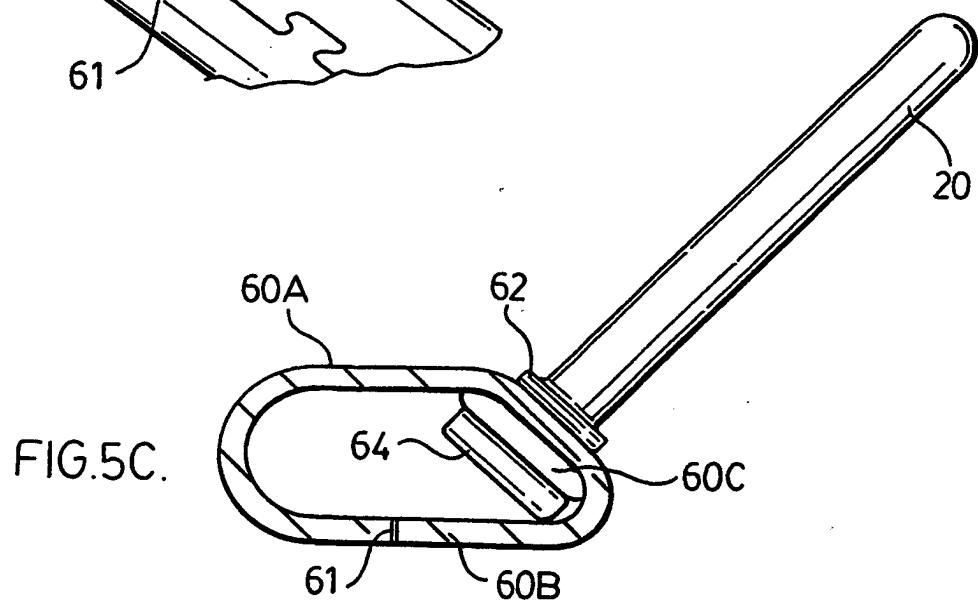
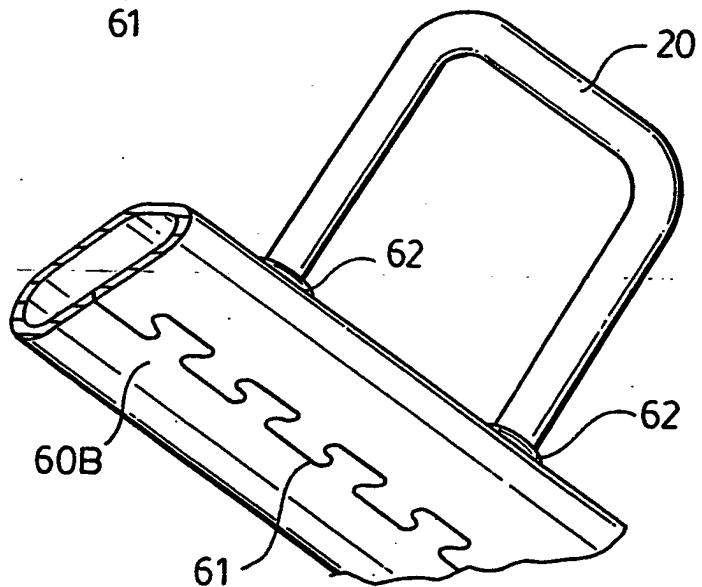
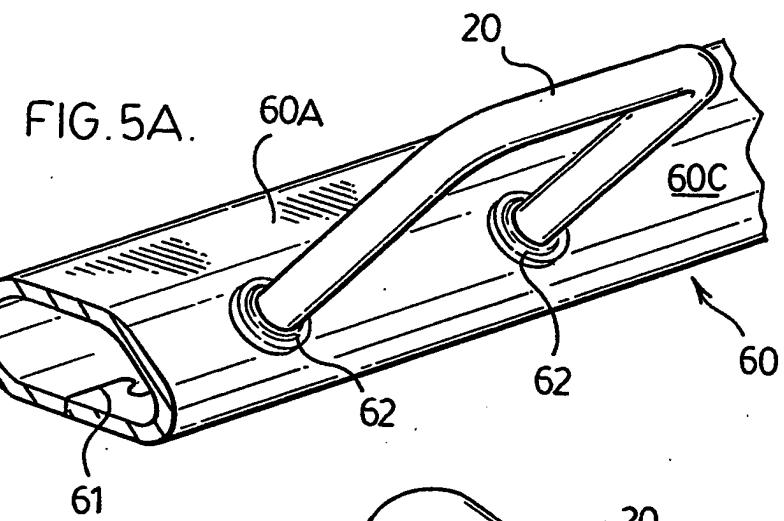


FIG. 4C.

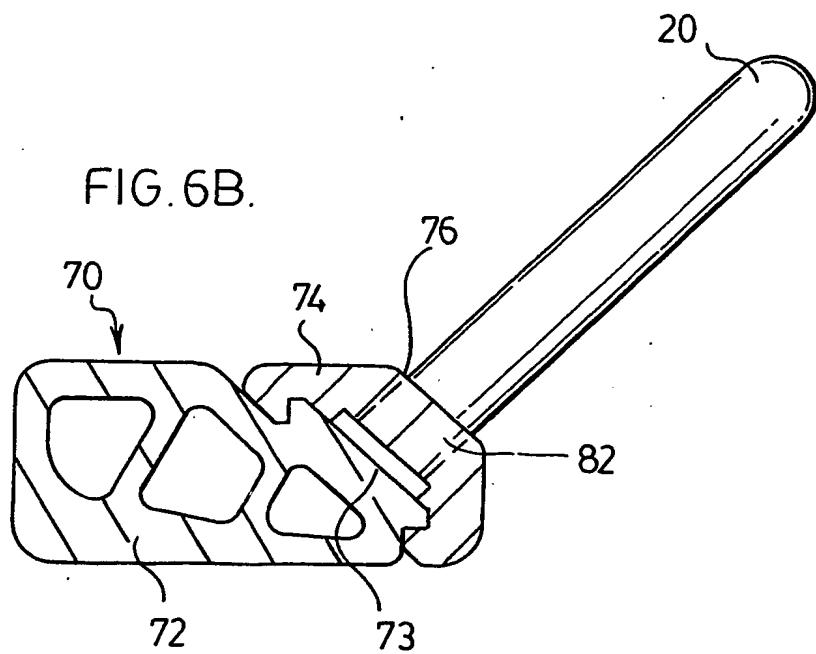
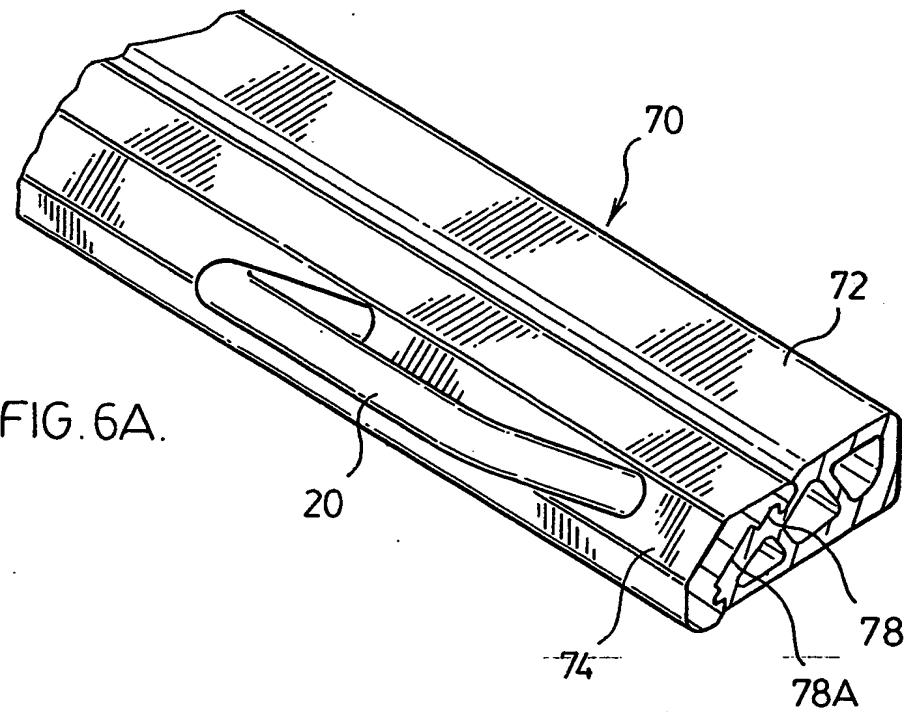
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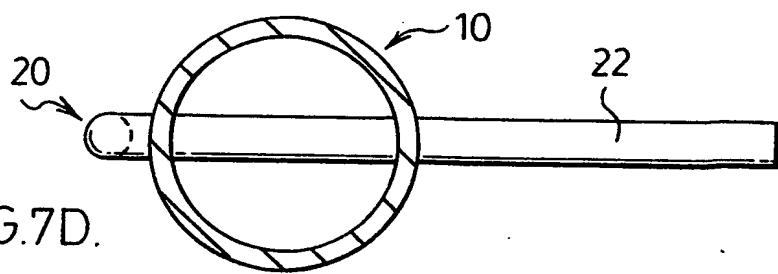
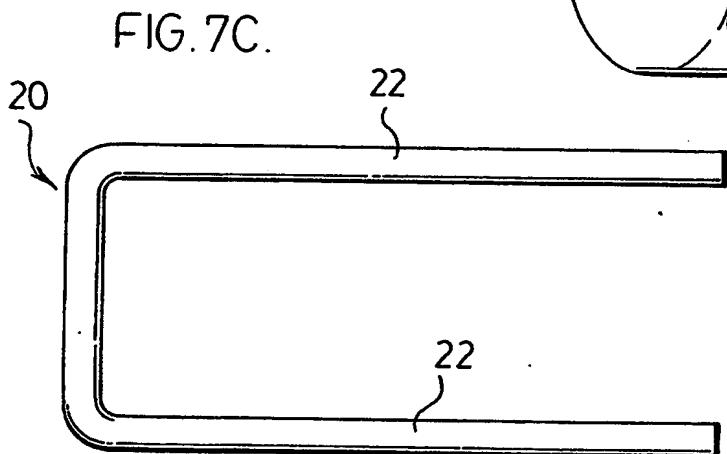
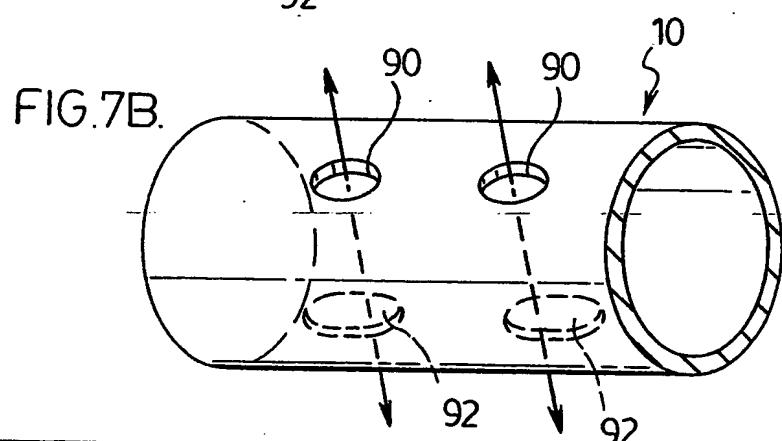
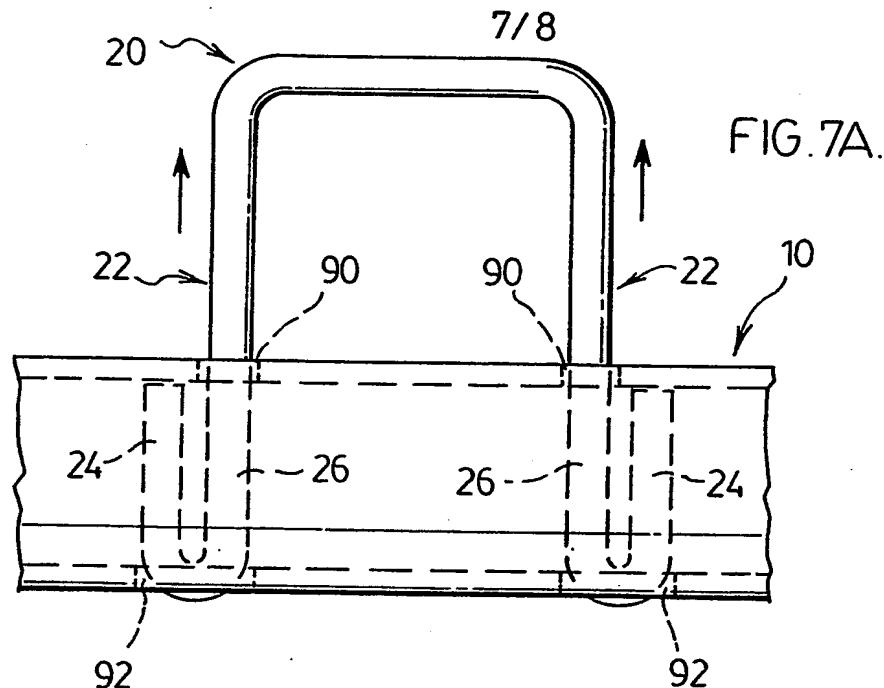


FIG. 7E.

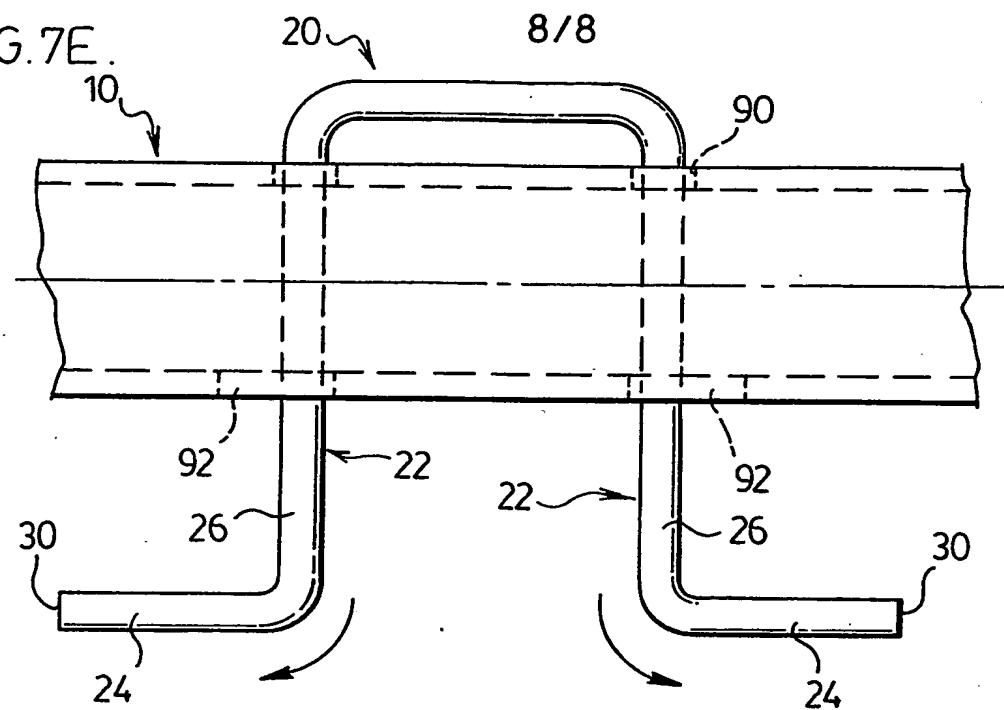
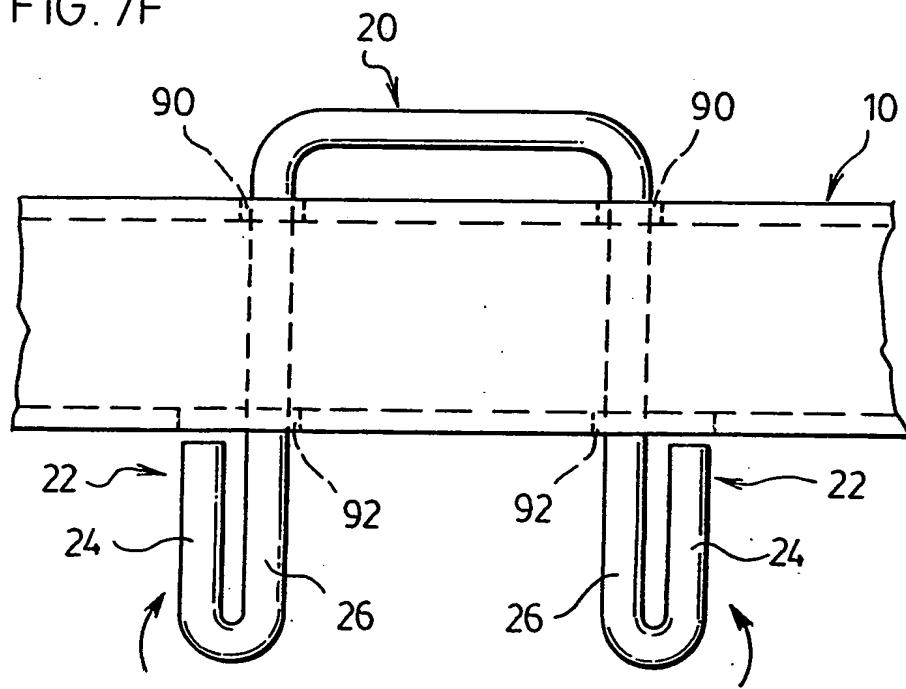


FIG. 7F



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## INTERNATIONAL SEARCH REPORT

|                 |                |
|-----------------|----------------|
| Internat        | Application No |
| PCT/CA 03/00226 |                |

|   |
|---|
| A. CLASSIFICATION OF SUBJECT MATTER<br>IPC 7 B60N2/28 |
|---|

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages                 | Relevant to claim No. |
|----------|--|-----------------------|
| X        | EP 0 694 436 A (LEAR SEATING ITALIA SPA)<br>31 January 1996 (1996-01-31)<br>figures 18,19          | 1,8                   |
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

18 June 2003

Date of mailing of the international search report

26/06/2003

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| Patent document cited in search report |    | Publication date |                      | Patent family member(s)                                | Publication date                                     |
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